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THE PROBLEM OF HIGH-VOLTAGE CABLE INSULATED WITH "ELEGAS"

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High-voltage cable insulated with gas under pressure has recently begun to obtain wide application.

During investigations of the electrical properties of various gases, the high electrical strength of sulfur hexafluoride, "elegas," was established and tested as filling for high-voltage cables. Preliminary studies of the breakdown strength of impregnated-paper cable in an "elegas" atmosphere (B. M. Gokhberg and M. V. Glikina, Zhurnal Tekhnicheskoy Fiziki, Vol XII, No 3, 1942) showed that the use of "elegas" instead of nitrogen or carbon dioxide doubled the breakdown strength.

Tests were made on gas-filled cables in cooperation with the "Sevkabel'" Plant. A three-strand 35-kilovolt cable with a common lead sheath was selected for the tests. The current-carrying strands in the cable were covered with metalized paper tape to create the smoothest possible surface for the strands. The strands were insulated with strips of impregnated paper 0.12 millimeters thick. After insulation, each strand was enclosed by a screen which fixed the field of the separate strands. A hard paper-braid filling was used in twisting the cable so that the lead sheath would retain its circular form and so that the gas would spread freely within the cable. Antimony was added to the lead to give the lead sheath (3 millimeters thick) high strength. The test cable produced was about 150 meters long.

Testing for Hermetic Sealing

A length of cable, sealed with end junction boxes, filled with nitrogen under a pressure of 3 atmospheres was observed for 24 hours. No marked pressure drop was recorded by a manometer, which demonstrated the good hermetic sealing of the cable with the end junction boxes.

Measurements of Ionization Curves

The ionization curves were recorded on 6-meter cable lengths. The measurements were made for cables filled with nitrogen, carbon dioxide, and "elegas" (SF_6). The cable was first evacuated, then scrubbed with the proper gas, and finally filled with gas to the required pressure.

Ionization begins in "elegas" at considerably higher voltages than in nitrogen and carbon dioxide (for the same pressures). Intense ionization begins at the same voltages for a cable filled with "elegas" to an excess pressure of 0.5 atmosphere and for cables filled with nitrogen or carbon dioxide to an excess pressure of 2.5 atmospheres. Tests of the breakdown strength of cables filled with nitrogen and carbon dioxide at 2.5 atmospheres pressure and for a cable filled with "elegas" at 0.5 atmosphere pressure showed that breakdown occurs at 100 kilovolts when voltage is applied for one hour.

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